

Тайтл: Firefighting Drones: functions, advantages, use cases

Дескриптор: Discover how drones are transforming approaches to combating forest, urban, and industrial fires. Explore how thermal imaging, AI, and autonomous systems enhance fire detection and suppression efficiency. Gain expert recommendations for senior executives and fire safety specialists on implementing drones in fire departments and emergency response services.

Описание на карточку в Тильде: Firefighting drones collect and analyze data faster than traditional methods. You can use them to coordinate firefighting efforts, ensuring firefighters' safety even in conditions of blinding smoke and high temperatures.

H1: How firefighting drones assist with wildfires, urban fires and industrial blazes

The year 2025 began with wildfires in California. Due to strong winds, large-scale forest fires engulfed Los Angeles, with flames spreading over an area exceeding 1,300 hectares. City authorities declared a state of emergency, and approximately 130,000 people received evacuation orders. Paris Hilton, Anthony Hopkins, Mark Hamill, and other celebrities have already lost their homes.

The fires are being suppressed using ground firefighting crews, helicopters, and aircraft dropping water and fire-extinguishing compounds. Additionally, fire suppression [drones](#) are being deployed in certain areas for situation monitoring, team effort coordination, and search and rescue operations.

In fact, fire departments worldwide are already actively utilizing drone technology in fire safety. In this article, we will examine in detail the applications of firefighting drones during fires, case studies of their deployment in aerial firefighting, advantages, and technical specifications of UAVs for firefighting.

What we will discuss in this article:

- What you need to know about firefighting drones
- Drone applications in firefighting: 7 effective use cases
- Drones for wildfire surveillance
- Urban fire response drones
- Industrial fire control drones
- What technical specifications should a firefighting drone have?
- How AI and ML Integration enhances fire-fighting drone efficiency
- How to implement a drone program in your fire department
- Key takeaways: transforming firefighting with drone technology

H2: What you need to know about firefighting drones

Firefighting drones are unmanned aerial vehicles that facilitate rapid fire response and provide a safe method for combating flames. They withstand high temperatures and are equipped with thermal cameras and sensors that detect and record infrared radiation.

Fire suppression drones assist firefighters in identifying fire hotspots, tracking fire spread, and assessing flame intensity even in conditions of poor visibility or at night.



Damage from the Los Angeles fires is estimated at \$135-150 billion, comparable to Hurricane Katrina

[Research](#) by the National Fire Protection Association indicates that the deployment of drones in disaster aftermath mitigation can enhance situational awareness and reduce the time required for damage assessment.

UAVs for firefighting are used worldwide: in the USA, Australia, Canada, and China. In the United States, for example, more than 900 state and local agencies associated with emergency services utilize drones.

Let's examine the primary ways drones are utilized in firefighting.

H2: Drone applications in firefighting: 7 effective use cases

1. Situation analysis (H3)

Firefighting drones provide a quick and safe way to assess the scale of a disaster. Equipped with high-resolution cameras, these UAVs transmit real-time, clear images of the situation. This enables operation commanders to make more informed decisions based on up-to-date data.

Advantages: rapid information acquisition, access to hard-to-reach areas, reduced risk for personnel during reconnaissance.

2. Team coordination

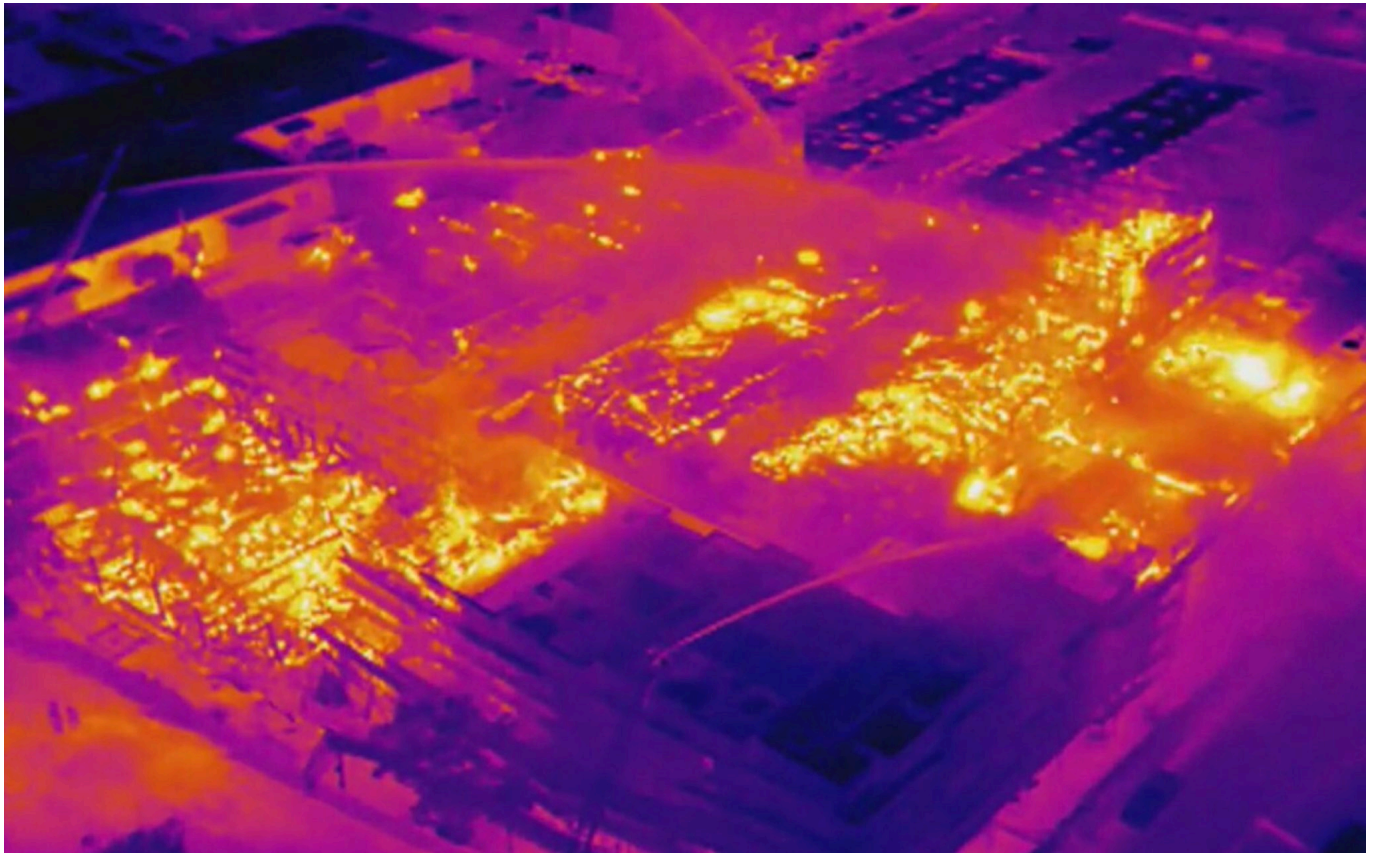
A fire department drone program helps efficiently manage resources at the incident site. From a bird's-eye view, UAV operators can guide firefighting units, indicating optimal routes and equipment deployment locations.

Advantages: improved tactical planning, enhanced firefighter safety, optimized resource utilization.

3. Thermal imaging monitoring

Thermal imaging drones for fire are equipped with infrared cameras capable of detecting fire hotspots even through smoke. This allows for tracking fire spread and identifying hidden heat sources.

Advantages: early detection of new fire outbreaks, monitoring firefighting effectiveness, ability to operate in low-visibility conditions.



4. Search and rescue operations

Emergency response drones are invaluable in locating victims and providing assistance. Equipped with thermal imagers and powerful searchlights, they can detect people in smoke-filled zones and hard-to-reach places.

Advantages: accelerated victim search, reduced risk for rescue personnel, ability to deliver first aid supplies.

5. Damage assessment

After fire containment, drone-based fire mapping helps quickly and accurately assess the damage. This is particularly important for insurance companies and for planning restoration work.

Advantages: detailed photo and video documentation, creation of 3D models of affected areas, expedited damage assessment and documentation process.

[Learn more about how drones assist emergency services in post-incident operations →](#)

6. Mapping and planning

Fire risk assessment drones are used to create detailed terrain maps before and after a fire. This aids in planning fire prevention measures and analyzing landscape changes.

Advantages: updating maps of fire-prone areas, planning preventive measures, monitoring ecosystem recovery after fires.

7. Infrastructure monitoring

Drones can be employed to monitor the condition of firefighting infrastructure such as hydrants and water reservoirs, further enhancing overall fire safety preparedness.

Advantages: regular inspection of fire fighting equipment, timely identification of problems, improvement of general fire fighting readiness.

Let us examine how drones assist in extinguishing various types of fires – including wildland, urban, and industrial conflagrations.

H2: Drones for wildfire surveillance

Combating wildland fires presents numerous challenges:

- Complex terrain often impedes access for ground firefighting crews,
- Rapidly changing weather conditions can swiftly alter fire behavior and spread,
- Smoke and darkness limit visibility,
- Firefighter operations in remote areas are extremely hazardous.

Moreover, wildland fires annually inflict irreparable damage to ecosystems and economies while claiming human lives. The fires in California have already caused damage comparable to Bolivia's GDP.

Incidentally, [Bolivia was also ravaged](#) by wildland fires last year. Experts there documented 40,000 ignition points and over 10 million hectares of burned natural areas. In 746 settlements, 12,000 families were affected. The fire destroyed pastures, severely impacting local agriculture and income sources.



Another danger of wildland fires is that they [produce 20% of total carbon dioxide emissions](#).

From a 4,000-hectare fire area, emissions amount to approximately 730,000 tons of CO₂. Such global consequences compel fire services worldwide to seek new, more effective, and technologically advanced means of fire suppression.

UAVs have become a revolutionary tool in combating wildland fires. Drones help prevent large-scale conflagrations by timely detecting new hotspots from the air, provide continuous perimeter monitoring, assist in team coordination, and conduct strategic operations, such as placing firebreaks.

Ivan Ivanov, expert at Microavia

The integration of drones into wildland firefighting systems offers several key advantages: (H3)

1. **Rapid data collection.** Drones can gather crucial information faster than traditional helicopter surveys, expediting response times.
2. **Enhanced inter-team communication.** Aerial imagery provides a clear situational overview, improving coordination between ground and aerial teams.
3. **Informed decision-making.** Aerial data enables fire service commanders to make more informed decisions, ultimately reducing risks for both firefighters and civilians.
4. **Cost-effectiveness.** Utilizing drones is less expensive than manned aircraft, allowing for more frequent and extensive monitoring. Today, drone implementation costs equivalent to a single helicopter flight, making drones significantly more economical.

5. **Safety.** By enabling real-time situation tracking, drones help firefighters avoid unnecessarily dangerous situations.

Country	Year	Consequences
Australia	2009	181 fatalities, over 750 homes destroyed
USA	2017	Approximately 100,000 hectares burned, 40 fatalities in Sonoma and Napa counties
Portugal	2017	66 fatalities, over 200 injured
Israel	2010	Around 250 homes and 10,000 hectares of forest burned, 50+ fatalities
Russia	2010	Over 800 fire outbreaks, 17 regions affected, 53 fatalities

Data on major wildland fires of the 21st century

H2: Urban fire response drones

Urban firefighting presents a unique set of challenges distinct from wildland fire suppression. Narrow streets and high-rise buildings restrict access for firefighting apparatus, while fire can rapidly spread between closely situated structures. The risk of structural collapse is significant. Moreover, the population density in major urban centers increases the potential for human casualties. The use of [drones helps to maintain public safety](#) even in such difficult conditions.

UAVs help mitigate these challenges by providing:

- Rapid aerial assessment of fire hotspots.
- Access to hazardous areas.
- Situational awareness for effective resource allocation.
- Real-time data transmission for incident management.
- Thermal imaging for fire detection and personnel localization.
- Monitoring of hazardous material spills or gas leaks.

Countries worldwide are already utilizing unmanned technologies for urban firefighting. For instance, in Lebanon, following the catastrophic port explosion in Beirut in August 2020, UAVs played a crucial role in damage assessment and recovery planning.

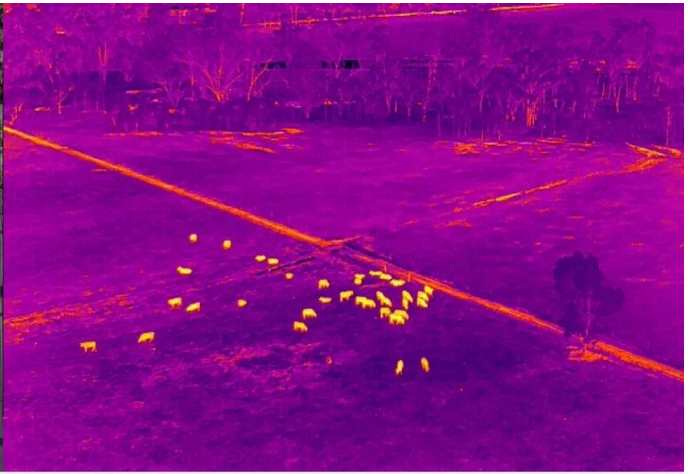
The New York City Fire Department has been employing UAVs since 2017. Drones provide aerial imagery that assists firefighters in identifying fire sources and assessing structural integrity. In Tokyo, UAVs equipped with thermal imaging cameras are used to navigate through dense smoke and locate victims in burning buildings.

Specialized UAVs are equipped with advanced technologies. The fire suppression drone-in-a-box solution by [Microavia](#) features an automatic battery replacement system for minimal ground time, resilience to extreme air temperatures, AI capabilities, and high-resolution cameras, making it ideal for complex urban environments.



Video camera

Video resolution 1920x1080 pix
Zoom optical/digital 30x/12x



Thermal sensor

Resolution 640x512 pix
Operating temperature range
-40°C to 85°C

UAVs provide substantial support to urban firefighters, enhancing their situational awareness. Aerial reconnaissance significantly reduces risks to firefighters' lives. This is crucial, considering the mortality statistics of firefighters in the line of duty – CTIF records over 25,000 fatalities annually.

Ivan Ivanov, expert at Microavia

Despite the evident advantages, it's important to note that UAV operations in urban areas are subject to strict regulations. In many countries, emergency services require special permissions to operate UAVs in populated areas, particularly during emergency situations. While the integration of unmanned aerial vehicles into urban firefighting systems presents certain challenges, it represents a significant advancement in emergency response capabilities.

H2: Industrial fire control drones

The integration of UAVs into industrial firefighting strategies significantly enhances emergency response capabilities. Such fires can occur in various settings, including chemical plants, oil refineries, warehouses, and manufacturing facilities. In these environments, complex infrastructure (large-scale equipment and multi-level structures) is compounded by the presence of combustible substances and gases that exacerbate the fire and impact the surrounding environment.

[Learn how UAVs are used at fire-prone sites in the oil and gas industry →](#)

How UAVs assist in combating industrial fires:

- **Rapid situation assessment.** Drones can access even the most hazardous areas – smoke-filled workshops or chemical storage facilities. Personnel cannot quickly inspect such spaces without specialized protective equipment, while UAVs allow for time-efficient reconnaissance without exposing firefighters to risk.

- **Fire and smoke propagation monitoring.** Real-time aerial imaging aids in predicting fire development and tracking smoke dispersion, which is crucial for evacuation planning.
- **Hazardous material detection.** Specialized sensors can identify chemical leaks or gas emissions, guiding containment efforts.

Drones for industrial firefighting must possess two key characteristics – thermal resistance and autonomy. Therefore, [Microavia's UAVs](#) can operate in proximity to zones with temperatures up to +50°C, while the automatic battery replacement capability ensures uninterrupted operation with minimal ground time.

The practice of utilizing UAVs at production and industrial sites is gaining momentum. As early as 2020, during an oil well fire in Colorado, a UAV was deployed to assess the situation from a safety perspective and provide incident commanders with feedback on the effectiveness of the operational plan.

H2: What technical specifications should a firefighting drone have?

Let's look at an example of a fire-fighting drone from [Microavia](#):

Autonomous system and rapid deployment (H3)

The Microavia UAV is an autonomous robotic system. It does not require an operator for functionality. Battery replacement is performed automatically, enabling 24/7 operation, with manual control capability as an option. The UAV can be rapidly deployed, which is crucial in fire situations where every minute counts.

Extended range and prolonged flight time

The Microavia drone is consistently prepared for a 45-minute continuous flight. Automatic battery replacement takes only 90 seconds, facilitating extended operations even over large-scale fires.

All-weather operations

Thermal resistance is a critical feature for UAV application during fires. Our UAVs have been field-tested in real conditions at temperatures ranging from -20°C to +50°C.

Infrared and thermal sensors

It has been demonstrated that [drones equipped with infrared and thermal sensors](#) enhance detection accuracy across various environmental conditions, which is crucial for effective surveillance and risk assessment. Upon request, drones can be outfitted with specialized fire detection sensors, such as those for gas detection.

Powerful long-range detection

- 30x optical zoom camera: enables long-distance detection and visual confirmation of objects with high clarity.
- Long-focus thermal imaging camera: monitor thermal signatures and identify potential threats or equipment malfunctions even in poor visibility due to smoke.
- Infrared cameras capture thermal signatures, allowing detection of hotspots and hidden fires through smoke, aiding in situation assessment and fire suppression planning.

- RTK technology enables precise fire location determination, reducing response time. Early detection and rapid response increase the chances of successful fire suppression.

[Learn more about Drone-in-a-Box system with automatic battery replacement →](#)



Drone-in-a-box

MICROAVIA

🕒 **>45 min**
max flight time

🌡️ **-20...+50°C**
tested in real operations

Fully isolated infrastructure
For better security, UTM can operate in the local network on client servers.

Minimum pause in operation
It takes 90 seconds to swap the battery and the drone is back in operation.

Centralized flight management
Remote control center and integration with other security system.

Day/Night operations
IR camera for targets highlighting and night operations.

Real-time data transmission and analytics

The capability to transmit and analyze data in real-time allows for immediate identification of critical hotspots and swift response to changing situations. Data can be automatically relayed to crisis management systems, ensuring up-to-date fire information and optimizing the suppression process. This feature transforms UAV monitoring from periodic events into continuous surveillance, enhancing overall operational efficiency and safety.

The combination of these technologies with traditional observation methods provides a comprehensive situational overview, improves firefighting tactics, and reduces risks to emergency responders.

H2: How AI and ML Integration enhances fire-fighting drone efficiency

- Automated hotspot detection. AI algorithms analyze drone-captured imagery to identify hotspots and early signs of ignition with high precision.
- Preventive monitoring. Machine learning models trained on historical fire data can forecast potential risks, enabling proactive measure planning.
- Landscape change detection. AI-based systems compare current images with historical data to automatically identify vegetation changes that may contribute to fire risks.
- Response efficiency optimization. Machine learning algorithms optimize drone flight routes and schedules, maximizing monitoring efficiency and action coordination.

H2: How to implement a drone program in your fire department

To maximize the effectiveness of drone programs, they should be integrated with existing crisis management systems. This will ensure a more coordinated and efficient response.

Let's consider the recommendations for drone implementation from Microavia expert [ИМЯ ФАМИЛИЯ] to enhance interaction between rescue teams and technological systems.

- Data Integration. Ensure seamless incorporation of drone data into existing crisis management systems and GIS.
- Workflow Integration. Include drone usage in standard fire monitoring and response procedures.
- Reporting Systems. Develop standardized reports that combine drone data with other fire and response information.
- Inter-agency Collaboration. Foster cooperation between drone teams, firefighting crews, and management services to effectively utilize the acquired data.

Proper integration maximizes efficiency by improving current processes without creating parallel systems.

H2: Key takeaways: transforming firefighting with drone technology

1. Drones significantly enhance firefighting efficiency by providing rapid situation assessment, improved team coordination, and safe inspection of hazardous areas.
2. Drone implementation is cost-effective: the investment is comparable to a single helicopter flight, while drones offer more frequent and extensive monitoring capabilities.
3. Thermal imaging cameras and infrared sensors on drones enable fire hotspot detection even in poor visibility conditions, which is critical for early detection and rapid response.
4. Integration of AI and machine learning into drone systems improves fire detection accuracy, optimizes flight routes, and enhances risk prediction.
5. Drones are effective in various scenarios: from wildland fires to urban and industrial blazes, adapting to the unique challenges of each situation.
6. The autonomy and rapid deployment of modern drones by Microavia ensure continuous 24/7 monitoring with minimal downtime.
7. For maximum effectiveness, drone programs should be integrated with existing crisis management systems, ensuring a more coordinated and efficient response.

H2: FAQ

Who will benefit from firefighting drones? (H3)

Unmanned Aerial Vehicles for fire services will be beneficial to:

Firefighting Teams:

- Enhanced situational awareness through aerial perspective.

- Real-time thermal imaging for hotspot detection.
- Improved resource allocation based on comprehensive data.
- Reduced exposure to hazardous conditions.

Residents in risk zones:

- Earlier warning systems through wider area surveillance.
- More accurate evacuation planning based on fire spread predictions.
- Improved public communication with up-to-date visual information.

Insurance companies:

- More precise risk assessment in fire-prone areas.
- Faster and more accurate post-incident damage evaluation.
- Potential for data-driven policy pricing and risk management.

Environmental scientists:

- Comprehensive data collection on fire behavior and environmental impact.
- Ability to track long-term ecological changes in fire-affected areas.
- Support for research on fire prevention and ecosystem recovery strategies.

City planners and local authorities:

- Data-driven urban planning for fire prevention.
- Improved emergency response strategies.

Search and rescue operations:

- Enhanced capabilities for locating missing persons in fire scenarios.
- Support for post-disaster assessment and recovery efforts.

Training and education:

- Provision of real-world footage for firefighter training.
- Public education on fire risks and prevention.

Cost efficiency:

- Reduction in equipment damage through better situational awareness.
- Optimization of resource deployment, potentially lowering operational costs.

Legal and investigative support: provision of detailed documentation for fire investigations and potential legal proceedings

Interagency cooperation: facilitation of better coordination between fire services, law enforcement, and other emergency responders.

These multifaceted benefits underscore the transformative potential of UAV technology in firefighting and related fields, contributing to safer communities and more resilient emergency response systems.

What are the advantages of using drones for fighting fires?

The advantages of using drones in firefighting operations include:

1. Enhanced firefighter safety: drones can access high-risk zones without endangering personnel.
2. Improved firefighting efficiency: real-time data enables more strategic resource allocation.
3. Minimized economic losses: faster fire suppression and targeted intervention reduce overall damage.
4. Reduced environmental impact: rapid identification of hazardous leaks allows for prompt containment.

What sets you apart from competitors?

Here are 7 key differences that make Microavia the superior choice:

1. Microavia drones ensure 98% uptime with only a 90-second interruption thanks to an automated battery replacement system. Competitors require over 32 minutes to charge from 20% to 90%, reducing effective operating time to less than 45%.
2. Unlike competitors, Microavia's drone-in-a-box integrates real-time tracking with AI-based object detection and alert systems, providing enhanced situational awareness for security and monitoring purposes.
3. Microavia's UAVs are ready for use in Gulf countries, field-tested, and can operate in high desert temperatures (+50°C).
4. Customization and flexibility: Microavia's module can be adapted to specific customer needs, including third-party payloads and hardware integration.
5. Extended battery life and reduced maintenance costs: Microavia drones use four batteries maintained at optimal temperature, providing over 500 operational cycles per battery. This ensures up to six months of uninterrupted operation without maintenance, compared to a single-battery system requiring maintenance after 1.5 months.
6. Proven track record with government entities: Microavia has established itself as a reliable supplier for government clients, including the Ministry of Defense, demonstrating its dependability in challenging conditions.
7. One-year warranty, training, and deployment included: Microavia provides a comprehensive service package that includes a one-year full coverage warranty, on-site operator training, and deployment assistance, ensuring seamless and efficient setup.

What resources and infrastructure are needed for implementing autonomous drone technology solutions?

Staff. Drone management and maintenance require a team, including drone operators, technicians, and data analysis. Training and training of employees is also required to create a headquarters responsible for coordinating the work of unmanned aerial vehicles.

Equipment. In addition to drones, you will need stations, flight control software, data analysis software, batteries, sensors, and cameras.

Communication infrastructure. It is necessary to ensure stable and fast data connections between drones and the central control system using mobile networks or other data transmission technologies.

How long do I have to wait for the drone to charge and be able to continue working?

Most existing drone systems require at least 35-60 min to recharge batteries after each flight. This can be a critical drawback in situations where continuous surveillance or emergency response is required.

Unlike these systems, Microavia's drone-in-a-box system provides for automatic battery swapping, allowing the drone to return to operation almost instantly after a quick battery change for 90 seconds.

The battery swapping functionality significantly reduces the drone's downtime to a minimum increasing the overall monitoring efficiency.

Can the drone operate at high temperatures?

The capabilities of drones vary in this regard. Microavia drones have been tested in real-world conditions ranging from -20°C to +50°C.

What stages does the drone implementation process include?

The project implementation includes the following stages:

1. Needs analysis and planning.
2. Demo flight and familiarization with the software at the site in Dubai.
3. Proof of Concept — testing at the client's facility.
4. Selection of equipment and technologies for the client's tasks.
5. Conclusion of the contract.
6. Production.
7. Staff training.
8. Deployment and integration.
9. Regular maintenance and updates.